

II. CLAIM AMENDMENTS

1-11. (cancelled)

12. (previously presented) A method for detecting pauses in speech recognition, in which method, for recognizing speech commands uttered by a user, the speech is converted into an electrical signal, the frequency spectrum of the electrical signal is divided into two or more sub-bands, samples of the signals in the sub-bands are stored at intervals, the energy levels of the sub-bands are determined on the basis of the stored samples, a power threshold value (thr) is determined, and the energy levels of the sub-bands are compared with said power threshold value (thr), wherein the comparison results are used for producing a pause detecting result, and further wherein a detection time limit (END) and a detection quantity (SB_SUFF_TH) are determined, wherein in the method, the calculation of the length of a pause in a sub-band is started when the energy level of the sub-band falls below said power threshold value (thr), wherein in the method, a sub-band specific detection is performed when the calculation reaches the detection time limit (END), it is examined on how many sub-bands the energy level was below the power threshold value (thr) longer than the time detection limit (END), wherein a pause detection decision is made if the number of sub-band specific detections is greater than or equal to the detection quantity (SB_SUFF_TH) and

further wherein an activity time limit (SB_ACTIVE_TH) and an activity quantity (SB_MIN_TH) are determined, wherein a pause detection decision is made if the quantity of sub-band specific detections is greater than or equal to the activity quantity (SB_MIN_TH) and the activity time limit (SB_ACTIVE_TH) has not been reached on the other sub-bands in the calculation of the length of the pause in the sub-band.

13. (cancelled)

14. (previously presented) A method for detecting pauses in speech recognition, in which method, for recognizing speech commands uttered by a user, the speech is converted into an electrical signal, the frequency spectrum of the electrical signal is divided into two or more sub-bands, samples of the signals in the sub-bands are stored at intervals, the energy levels of the sub-bands are determined on the basis of the stored samples, a power threshold value (thr) is determined, and the energy levels of the sub-bands are compared with said power threshold value (thr), wherein the comparison results are used for producing a pause detecting result, wherein a pause detection is performed on each sub-band on the basis of the comparison results, the number of sub-bands on which a pause is detected are compared with an activity threshold, wherein if the number of sub-bands on which a pause is detected is greater than said activity threshold, it is deduced that there is a pause in the speech, and further wherein the power threshold value (thr) is calculated by the formula:

$$thr = p_min + k \cdot (p_max - p_min), \text{ in which}$$

p_min = the smallest power maximum determined of the stored samples of the sub-bands, and

p_max = the greatest power minimum determined of the stored samples of the sub-bands

k = a factor that is greater than zero and less than one.

15. (previously presented) The method according to claim 12, characterized in that said power threshold value (thr) is calculated adaptively by taking into account the environmental noise level at each instant.

16. (previously presented) A method for detecting pauses in speech recognition, in which method, for recognizing speech commands uttered by a user, the speech is converted into an electrical signal, the frequency spectrum of the electrical signal is divided into two or more sub-bands, samples of the signals in the sub-bands are stored at intervals, the energy levels of the sub-bands are determined on the basis of the stored samples, a power threshold value (thr) is determined, and the energy levels of the sub-bands are compared with said power threshold value (thr), wherein the comparison results are used for producing a pause detecting result, wherein a pause detection is performed on each sub-band on the basis of the comparison results, the number of sub-bands on which a pause is detected are compared with an activity threshold, wherein if the number of sub-bands on which a pause is detected is greater than said activity threshold, it is deduced that there is a pause in the speech, wherein said power threshold value (thr) is calculated adaptively by taking into account the environmental noise level at each instant and further wherein, for calculating said power threshold value (thr), a modification coefficient (UPDATE_C) is determined, and on the basis of the stored samples, the greatest power level (win_max) and the smallest power level (win_min) of the sub-bands are calculated, wherein the power maximum (p_max) and power minimum (p_min) are determined by the formulae:

$$p_max(i, t) = (1 - UPDATE_C) \cdot p_max(i, t - 1) + (UPDATE_C \cdot win_max)$$

$$p_min(i, t) = (1 - UPDATE_C) \cdot p_min(i, t - 1) + (UPDATE_C \cdot win_min)$$

in which $0 < UPDATE_C < 1$,

$0 < i < L$, and

L is the number of sub-bands

t is an integer number having a value greater than or equal to 1 representing different moments in time, wherein $t-1$ is the moment in time preceding t .

17. (previously presented) The method according to claim 16, characterized in that further in the method,

- the modification coefficient (UPDATE_C) is increased, if the absolute value of the difference between said calculated highest power level (win_max) and the power maximum (p_max), or the absolute value of the difference between said calculated lowest power level (win_min) and the power minimum (p_min) has increased,
- the modification coefficient (UPDATE_C) is reduced, if the absolute value of the difference between said calculated highest power level (win_max) and the power maximum (p_max), or the absolute value of the difference between said calculated lowest power level (win_min) and the power minimum (p_min) has decreased.

18. (previously presented) A speech recognition device (16) comprising:

- means (1a, 1b) for converting speech commands uttered by a user into an electrical signal,
- means (8) for dividing the frequency spectrum of the electrical signal into two or more sub-bands,
- means (14) for storing samples of the signals of the sub-bands at intervals,

- means (5, 13) for determining energy levels of the sub-bands on the basis of the stored samples,
- means (5, 13) for determining a power threshold value (thr),
- means (5, 13) for comparing the energy levels of the sub-bands with said power threshold value (thr), and
- means (5, 13) for detecting a pause in the speech on the basis of said comparison results, wherein the power threshold value is calculated by the formula

$$thr = p_min + k \cdot (p_max - p_min), \text{ in which}$$

p_min = the smallest determined power maximum of the stored samples of the sub-bands, and

p_max = the greatest determined power minimum of the stored samples of the sub-bands

k = a factor that is greater than zero and less than one.

19. (previously presented) The speech recognition device (16) according to claim 18, characterized in that it comprises also means (10, 11) for filtering the signals of the sub-bands before storage.

20. (currently amended) A method for detecting pauses in speech during speech recognition comprising the steps of:

recognizing speech uttered by a user;

converting said speech into an electrical signal;

dividing the frequency spectrum of the electrical signal into two or more sub-bands;

storing samples of the signals in the sub-bands at intervals;

calculating the energy levels of each of the sub-bands on the basis of the stored samples;

setting a power threshold value;

comparing the calculated energy levels of each of the sub-bands with said power threshold value;

counting the number of sub-bands in which said calculated energy level ~~is~~ levels are below said ~~energy level~~ power threshold value;

setting an activity threshold for determining a pause in said speech at a predetermined number of sub-bands;

comparing said counted number of sub-bands with said activity threshold, wherein, if said counted number of sub-bands is greater than said activity threshold, a pause in speech is indicated

determining an activity time limit (SB_ACTIVE_TH) and an activity quantity (SB_MIN_TH), wherein a pause detection decision is made if said counted number ~~the quantity of sub-band specific detections~~ is greater than or equal to the activity quantity (SB_MIN_TH) and the activity time limit

(SB_ACTIVE_TH) has not been reached on the ~~other sub-bands~~ a sub-band in the ~~a~~ calculation of the ~~a~~ length of the pause in the sub-band..

21. (currently amended) A method according to claim 20, further comprising ~~the steps of:~~

setting a predetermined time threshold; and counting the number of sub-bands in which said calculated energy level ~~is~~ levels are below an energy level threshold value for at least said predetermined time threshold.

22. (New) A speech recognition device comprising:

a converter for converting speech commands uttered by a user into an electrical signal; a divider for dividing the frequency spectrum of the electrical signal into two or more sub-bands;

a memory for storing samples of the signals of the sub-bands at intervals;

a processor configured to determine energy levels of the sub-bands on the basis of the stored samples; determine a power threshold value (thr); compare the energy levels of the sub-bands with said power threshold value (thr); and detect a pause in the speech on the basis of said comparison results;

wherein said processor is configured to calculate the power threshold value by the formula

$$thr = p_min + k \cdot (p_max - p_min), \text{ in which}$$

p_{\min} = the smallest determined power maximum of the stored samples of the sub-bands, and

p_{\max} = the greatest determined power minimum of the stored samples of the sub-bands

k = a factor that is greater than zero and less than one.